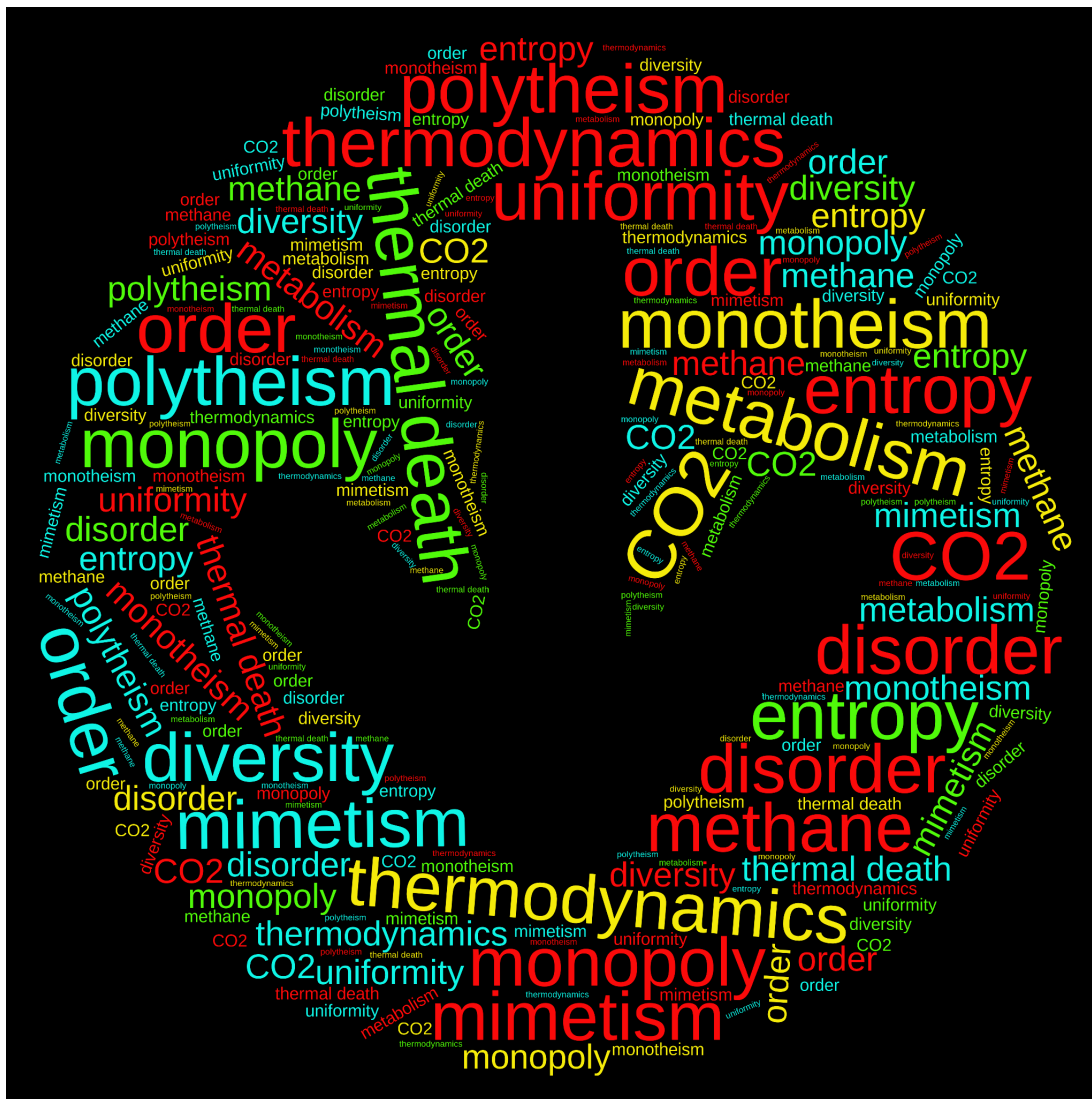


Monotheism and increased entropy.

A short essay on the thermodynamics of culture.

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ABSTRACT: Living organisms are as much subject to entropy as inorganic matter is. Human culture and its products are no exception. We show how ethological and psychological phenomena like mimetism, economic phenomena like monopolies, and belief systems like monotheism, follow the 2nd Law of Thermodynamics.

15 pages. 8 references.

Keywords: anthropology, Christianity, entropy, Islam, Judaism, metabolism, methane, mimetism, monopolies, monotheism.

In this little essay, I will try to explain the prevalence and resilience of **monotheism** and psychological and ethological phenomena like **mimetism**, and **economical** like monopolies, as the product of a basic and universal physical law known as the 2nd Law of Thermodynamics.

1. Definition of entropy:

The central concept of the 2nd Law of Thermodynamics is called entropy, from the Greek τροπή tropé, meaning transformation. The most general version of this law is called cosmological entropy that applies to the whole universe and its parts and sustains that the universe evolves from an initial state of maximum order to a predicted final state of total disorder called thermal death.

We use the word “law” under protest. A statute can be broken and still remain a law; a physical “law” that is broken was never one. What we call laws of nature are only the regularities we have assessed — statements of what is more and what is less probable. Newton himself declined to say what gravity is, content to describe how it acts.

There is nothing mysterious about entropy. It’s not a force, like gravity¹. Entropy is a concept that refers to the fact that disorder is more probable than order, for the simple mathematical reason that there are many more possibilities for things to be chaotic than to be organized.

Order is less probable than disorder, and to be kept it demands energy. Any island of order — a crystal, a cell, an institution — persists only so long as energy is spent to hold it off the far more probable disordered state; withdraw the energy and it drifts back. And the improbability of order holds wherever there are many ways to be disordered and few to be ordered — in a gas, in a cell, and, as we will argue, in a culture.²

In this theory, order means diversity and disorder means the leveling of differentials. The final state of the universe would be homogenous with low energy.

¹That science does not yet fully understand.

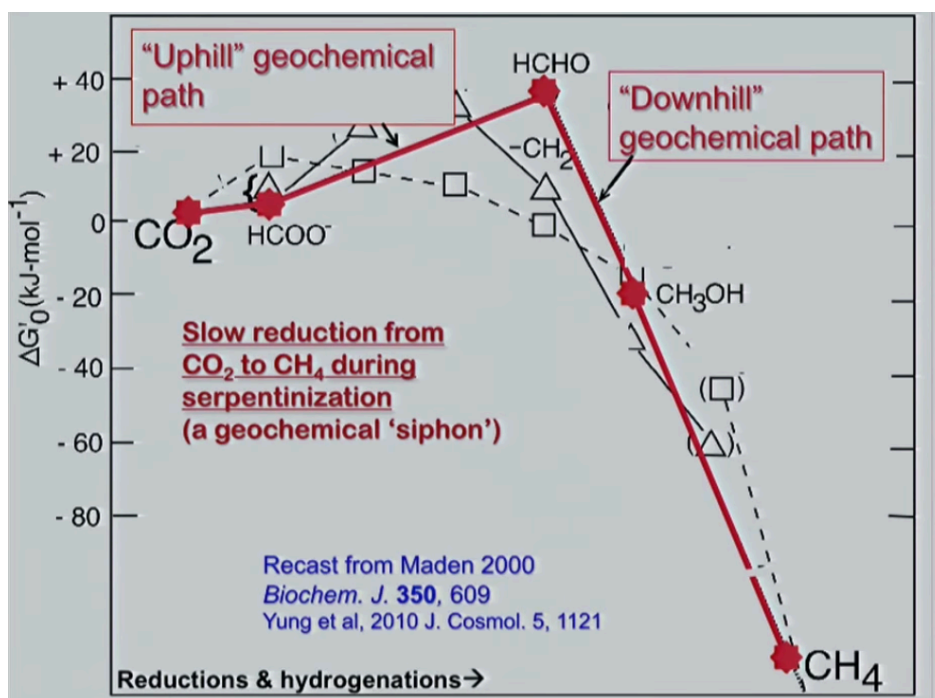
² The qualitative claim — that order is rare and costly in culture as elsewhere — stands on its own. A quantitative cultural entropy, with a defined measure over cultural “microstates,” remains to be constructed; we do not assume one here.

This transformation from diversity to the leveling of differentials is not a perfectly linear process, there are detours in the road to entropy. Life is one of these detours.

2. Entropy and life:

The **metabolic theory** of the origin of life (RUSSELL, M. 2006) states that the movement towards entropy facilitated the formation of *engines* that hydrogenate CO_2 ³. These engines are proteins that feed energy to most eukaryotic⁴ living beings, including us. As living beings, we have all the same function, which is to take in hydrogen and carbon dioxide and put out methane.

Hydrogen can't link directly to CO_2 . The formation of organisms is the *upward slope* of the *detour* in the road to entropy, an organism has more order than its chemical components. The production of methane by the organism is the *lower slope* of the detour and has higher entropy than the initial state where hydrogen and carbon dioxide weren't linked.



The graphic⁵ shows the *detour* (“uphill” geochemical path) in which life exists — the slow reduction of CO_2 to methane it traces takes place during serpentinization (the reaction of water with iron- and magnesium-rich rock that releases hydrogen at deep-sea hydrothermal vents). The final result is always increased entropy (“downhill” geochemical path), a return from the detour to the main road.

³These engines are the protein ATP synthase, the enzyme that manufactures ATP, the molecule that powers virtually every process in the cell.

⁴Organisms whose cells have a nucleus. All animals, plants, fungi, and many unicellular organisms, are Eukaryotes. Certain species of fungi and protists don't produce ATP.

⁵Slide extracted from Michael Russell's: *On the Emergence of Life Through “Negative” Entropy Trapping*.

This refutes the claim that science has nothing to say about the purpose of life. *The purpose of life is to hydrogenate CO² to produce methane* (or in Russells' terms: *to produce waste*) . That's what we do best, and we do it around the clock. Everything else is *vanity of vanities*.

The universe drifts from diversity to the leveling of differentials. The theory of cosmological entropy predicts that the final state of the universe would be homogenous with low energy. Life is no more than a detour in this drift, but its main function is to yield more entropy.

3. Mimetism:

Many forms of life are mimetic. In camouflage, plants and animals take colors and shapes that imitate their surroundings or elements of it. Some butterflies take the shape and color of leaves, other insects take the shape of branches, the cuckoo bird lays eggs with the colors and patterns of other birds so that these nest them, the mimetic camouflage talents of the chameleon are proverbial, herd behaviors are mimetic. There are many more examples.

All animals capable of learning, that is changing or acquiring behaviors, are to some degree mimetic. This trait is more conspicuous in some animals. The verb *to ape* reflects the fact that primates in general are reputed for their imitative skills.

Among the primates, we humans are extremely mimetic. René Girard (1972), the French literary theorist and anthropologist of religion, formulated a mimetic theory of desire through which he tried to explain human psychology, societies, culture and history.

Learning is a basically mimetic process. As social animals, our need to belong to a herd, tribe, group is fulfilled through imitation.

Culture consists of shared languages, customs, rituals, values, techniques... that are acquired through and based on imitation.

There is a constant trend in civilization to level differentials, i.e. to standardize juridical, political, financial, and educational systems, among many others. Almost a century ago, Henry Miller declared that all cities look the same, there are cars everywhere. Living today, he could have added McDonald's, Starbucks, Dunkin' Donuts, and much more.

Fashion is a mimetic phenomenon. It's easy to see what time a film or TV show belongs to by observing the hairstyles. Jeans, initially designed for miners in the 19th-century California gold rush, have since the 1970s covered the planet and are worn by all social strata. Even if they are worn in multiple contexts and for different reasons and functions, they were only invented once by Jacob Davis and Levi Strauss in 1873, all that followed is imitation.

Imitation is fundamental in the understanding of human existence and societies. Its result is the leveling of differentials.

4. Diversity

Diversity can diminish at a fast rate:

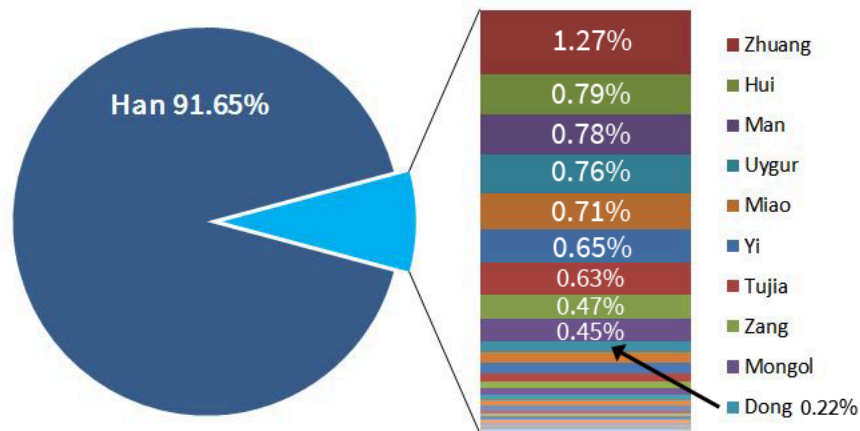
Each year 9 languages, or one every 40 days, cease to be spoken. By 2080, the rate will rise to 16 languages per year (SIMONS, G.F., 2019). So do cheese varieties, except in France where there were 365 in the 60s and 1200 now. De Gaulle was reputed to say that a country with 365 varieties of cheese couldn't be ruled. In fact, even in France, the varieties of cheese available in the average supermarket diminish from year to year and one single variety, Camembert, has 60% of the market share.

The expansion of human populations and human activities and the habitat destruction that inevitably results is the primary cause of the decay of organic diversity.

Paul Erlich (1988) warned that extrapolation of current trends in the reduction of diversity implies a *dénouement* for civilization within the next 100 years comparable to a nuclear winter.

Paradoxically, the increase in population leads to a diminution of diversity. For example, China is composed of 55 recognized ethnic groups, but more than 90% of the population belongs to one single ethnic group, the Han:

**Han Chinese are the largest ethnic group in China.
55 ethnic groups are officially recognized as minority groups.**



Source: https://en.wikipedia.org/wiki/List_of_ethnic_groups_in_China

On an even larger scale, China as a whole and its neighboring countries, especially Japan, are drifting towards Western civilization. The whole *globalization* phenomenon can be understood as the loss of diversity and a leveling of differentials.

As all roads lead to Rome, even more so do they lead to the **leveling of differentials**, i.e. entropy. Though the final destination is ineluctable, the road isn't straight and has many *detours*, that's where human and natural creativity happens.

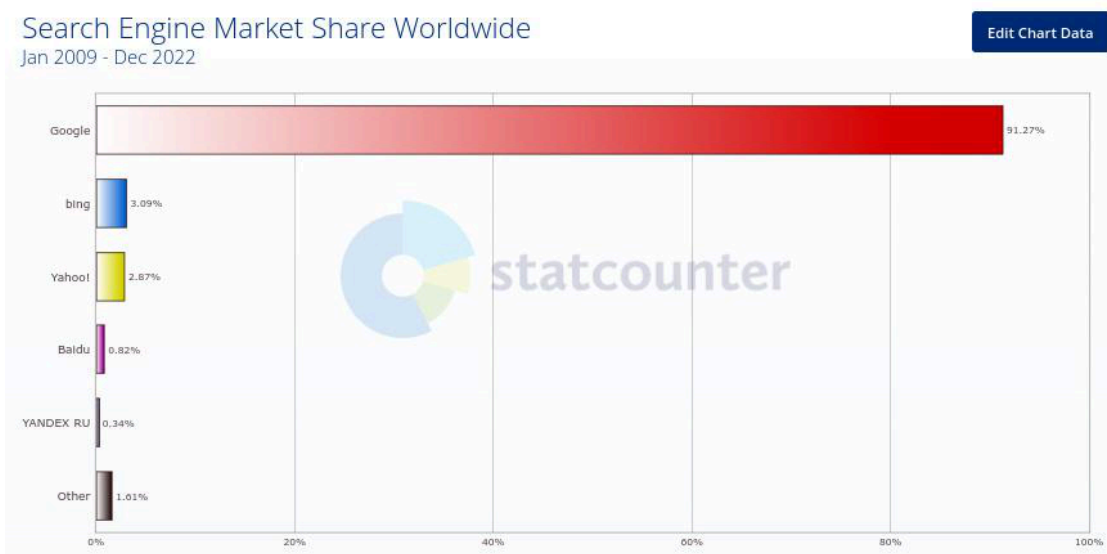
Even with globalization at its full speed, tendencies to regionalisms, minority rights and gender diversification, among others, emerge. But in the big picture, these tendencies are small detours from the road of entropy that levels all differentials.

5. Monopolies

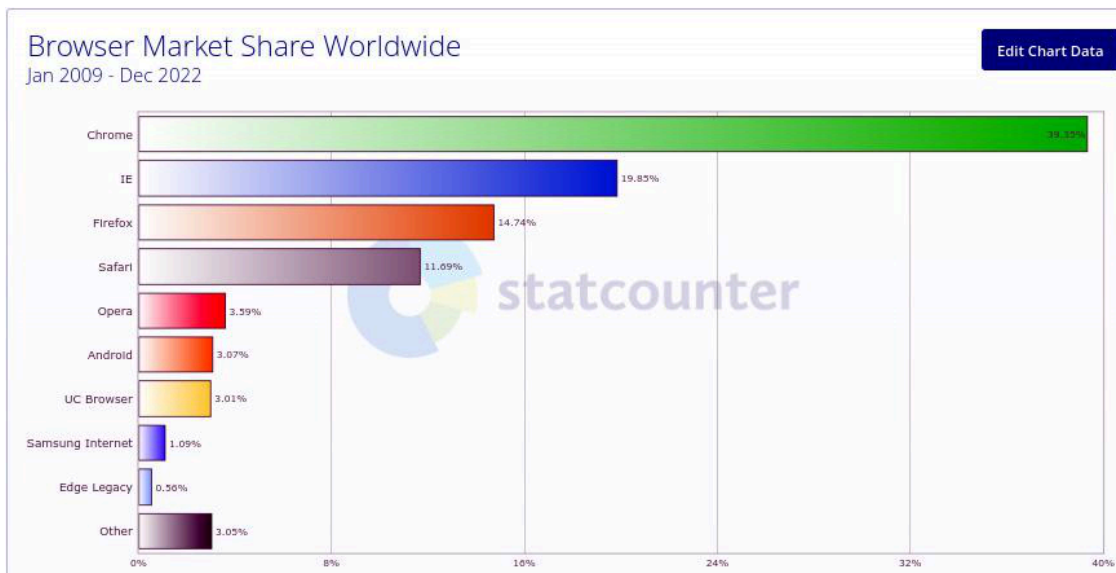
“Free competition”, so exalted by business school professors, in many instances leads to the formation of oligopolies and monopolies. That’s the reason for most developed economies to have **antitrust laws** or its equivalents.

The *free competition* principle was, more or less, adapted to markets that are much smaller than those created by the *internet revolution*. Paradoxically, the much larger and extended *digital markets* are more prone to the formation of monopolies.

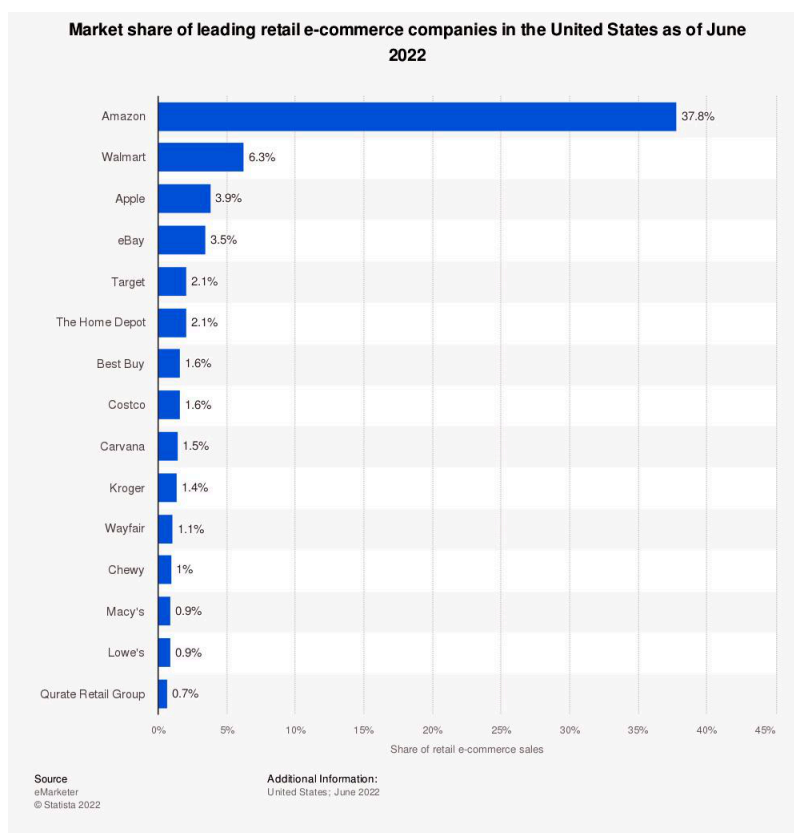
In the late 90s there still were more than a dozen competing search engines. Today, one single search engine has a more than 90% market share:



We see the same evolution in the web browser market:



And, of course, in e-commerce:



Monopolies can be understood as entropic leveling of differentials from the perspective of consumer behaviors and of the economic landscape. Libertarian and contrarian Peter Thiel

(2014), one of the founders of PayPal, has the inverse perspective, where free competition, i.e. market diversity, lead to entropy, and monopolies oppose it:

“Whatever your views on thermodynamics, it is a powerful metaphor⁶. In business, equilibrium means stasis, and stasis means death. If your industry is in a competitive equilibrium, the death of your business won’t matter to the world; some other undifferentiated competitor will always be ready to take your place.

Perfect equilibrium may describe the void that is most of the universe. It may even characterize many businesses. But every new creation takes place far from equilibrium. In the real world outside economic theory, every business is successful exactly to the extent that it does something others cannot.

Monopoly is therefore not a pathology or an exception. Monopoly is the condition of every successful business.”

Thiel is right and so are we, saying exactly the contrary: that monopolies lead to entropy. How so? Because, as we have already said, all roads lead to Rome. Despite all the possible *detours*, be it free competition or monopolies, the end of the road is the same: maximum entropy.

6. Monotheism

Monotheism is such an unquestioned and pervasive idea in our world that we take for granted that it represents a great advance, a progress in the evolution of humanity.

The idea of the existence of a single God, with a capital “G” appears to be so normal and self-evident that nobody is asked if he believes in gods, in the plural form.

Monotheism has this undeserved prestige despite going against the liberal values we most cherish, such as tolerance, openness, pluralism, diversity, and decentralization, among others.

Monotheism also goes against logic and scientific knowledge. There are four basic forces in nature: the strong force, the weak force, the electromagnetic force, and gravity. No one is more fundamental than the other. These forces “act” conjointly but are independent of each other⁷.

There are no more reasons to believe that there is one god than there are two or four or many. In fact, there are many reasons not to believe in gods or supernatural beings in general.

⁶Unlike Thiel, we do not use thermodynamics as a metaphor. Nor are we claiming that culture “obeys” a law imported from physics. We claim something simpler and harder to evade: that culture is one more system in which ordered states are rare and costly to maintain, so that it drifts, like everything else, toward the probable. That is not an analogy to the physics. It is the same improbability of order, in another material.

⁷There is a “Trinitarian” Grand Unified Theory (GUT) model in particle physics that attempts to unify the three interactions of the Standard Model — the strong, weak, and electromagnetic forces — into one single force. That’s just an entropic unifying theory that has not been proven.

Despite all that goes against it, the fact is that monotheism is a persistent and prevalent belief, and as such it needs to be explained.

Renan, the nineteenth-century French historian of religions, thought that monotheism became a strong idea only after Rome transformed into an empire. The idea of one god only began to become plausible when the known world was ruled by one man: the Roman emperor. It only became an absolute dogma with the emergence of Islam.

Renan's idea is good at explaining why monotheism had a successful start, but it doesn't explain why it prevails in a world where the Roman Empire is no more, and that is ruled by several leaders in different places.

That monotheism ultimately leads to atheism is almost a trite idea:

polytheism → monotheism → atheism

This movement is effectively entropic, and could be described as:

diversity → leveling of differentials → maximum entropy

The universality of Buddhism, Christianity, Islam... is also a movement towards the leveling of differentials. Catholicism comes from the Greek καθολικός *katholikos* meaning universal.

Jewish monotheism incited Paul of Tarsus to open the Jewish faith to gentiles who had long been visiting synagogues (FREDIKSEN, P., 2017) because polytheists were open to other cults and the piety and beauty of the synagogue rituals attracted many of them.

The movement from monotheism to atheism is well attested. Jews are reputed to be predominantly agnostics or atheists, so are the peoples of Western Europe. In the Maghreb the tendency to atheism increases even if the laws of the Muslim countries consider it a crime.

Inside Judaism, there is the tendency to disincarnate God, to make Him transcendent instead of immanent. We see this evolution, in chronological order, from Philo to Onkelos, from Ibn Pakuda to Maimonides and to Hermann Cohen. The same evolution can be, less clearly, traced in Christianity from Aquinas to Hans Küng. In Islam Sufism goes in the same direction.

These tendencies can be understood as a movement toward atheism. Instead of completely abandoning the idea of God, they instead strip Him of His immanent qualities.

We will only accept that monotheism is progress for humanity the day that there'll be more polytheistic than monotheistic terrorists, and the day where more wars will be fought in the name of a coalition of gods instead of in the name of a single one. But we cannot deny the fact that monotheism is progress toward increased entropy.

Conclusion: From anthropology to entropology.

"In the long run we are all dead"
Keynes (1923)

No matter how exceptional we may feel, humans are not more or less than any other life form. We and all our products, material and immaterial, are subject to the same laws of nature.

We may resist this process of destruction, but in the long run increased entropy will always prevail.

Lévi-Strauss, the founder of structural anthropology, pessimistically understood this in his 1955 concluding remarks to his memoir *Tristes tropiques*:

"... civilization taken as a whole, can be described as an extraordinary complex mechanism, which we might be tempted to see as offering an opportunity of survival for the human world, if its function were not to produce what physicists call entropy, that is inertia. Every verbal exchange, every line printed, establishes communication between people, thus creating an evenness of level, where before there was an information gap and consequently a greater degree of organization.

Entropology, not anthropology, should be the word for the discipline that devotes itself to the study of this process of disintegration in its most highly evolved forms."

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